

Claims

1. A plasma display panel in which a pair of substrates are disposed so as to oppose each other and have a discharge space therebetween and in which a dielectric protection layer including MgO and phosphor layers for red, green, and blue respectively are formed so as to face the discharge space, wherein

none of phosphor members included in the phosphor layers contain, in a composition thereof, a Group IV element.

2. The plasma display panel of Claim 1, wherein

none of the phosphor layers are made of a substance that contains any Group IV element.

3. A plasma display panel in which a pair of substrates are disposed so as to oppose each other and have a discharge space therebetween and in which a dielectric protection layer including MgO and phosphor layers for red, green, and blue respectively are formed so as to face the discharge space, wherein

each of the phosphor layers contains at least one Group IV element.

4. The plasma display panel of Claim 3, wherein

a content ratio of said at least one Group IV element in each of the phosphor layers is no larger than 5,000 mass ppm.

5. The plasma display panel of Claim 3, wherein

a content ratio of said at least one Group IV element in each

of the phosphor layers is within a range between 100 mass ppm and 5,000 mass ppm inclusive.

6. The plasma display panel of Claim 3, wherein

5 a phosphor member included in at least one of the phosphor layers contains, in a composition thereof, at least one Group IV element.

7. The plasma display panel of Claim 3, wherein

10 a content ratio of said at least one Group IV element in each of the phosphor layers is within a range between 100 mass ppm and 50,000 mass ppm inclusive, and

the content ratio is substantially same for all of the phosphor layers.

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8. The plasma display panel of Claim 7, wherein

variations among the phosphor layers with respect to the content ratio of said at least one Group IV element are no larger than 20,000 mass ppm.

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9. The plasma display panel of Claim 7, wherein

for each of the phosphor layers, a phosphor member containing, in a composition thereof, at least one Group IV element is selected so as to be included in the phosphor layer.

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10. The plasma display panel of Claim 9, wherein

said at least one Group IV element contained in the composition of the phosphor member is in common with all of the phosphor layers.

11. The plasma display panel of one of Claims 1 and 3, wherein said Group IV element is Si.
- 5 12. The plasma display panel of Claim 11, wherein compositions of the phosphor members are $\text{Y}_2\text{SiO}_5\text{:Eu}$ for red, $\text{Zn}_2\text{SiO}_4\text{:Mn}$ for green, and $\text{Y}_2\text{SiO}_3\text{:Ce}$ for blue.
13. The plasma display panel of Claim 3, wherein
10 in each of the phosphor layers, said at least one Group IV element contained is a compound being distinct from any phosphor members included in the phosphor layer.
14. A plasma display panel in which a pair of substrates are
15 disposed so as to oppose each other and have a discharge space therebetween and in which a dielectric protection layer including MgO and phosphor layers for red, green, and blue respectively are formed so as to face the discharge space, wherein
none of phosphor members included in the phosphor layers
20 contain, in a composition thereof, any member of the group consisting of W, Mn, Fe, Co, and Ni.
15. The plasma display panel of Claim 14, wherein
none of the phosphor layers are made of a substance that contains
25 any member of the group consisting of W, Mn, Fe, Co, and Ni.
16. A plasma display panel in which a pair of substrates are disposed so as to oppose each other and have a discharge space therebetween

and in which a dielectric protection layer including MgO and phosphor layers for red, green, and blue respectively are formed so as to face the discharge space, wherein

each of the phosphor layers contains at least one transition
5 metal.

17. The plasma display panel of Claim 16, wherein
a content ratio of said at least one transition metal in each
of the phosphor layers is no larger than 30,000 mass ppm.

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18. The plasma display panel of Claim 16, wherein
a content ratio of said at least one transition metal in each
of the phosphor layers is within a range between 500 mass ppm and
30,000 mass ppm inclusive.

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19. The plasma display panel of Claim 16, wherein
a phosphor member included in at least one of the phosphor
layers contains, in a composition thereof, at least one transition
metal.

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20. The plasma display panel of Claim 16, wherein
said at least one transition metal is selected from the group
consisting of W, Mn, Fe, Co, and Ni.

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21. The plasma display panel of Claim 20, wherein
a content ratio of said at least one transition metal in each
of the phosphor layers is within a range between 300 mass ppm and
120,000 mass ppm inclusive, and

the content ratio is substantially same for all of the phosphor layers.

22. The plasma display panel of Claim 21, wherein
5 variations among the phosphor layers with respect to the content ratio of said at least one transition metal are no larger than 40,000 mass ppm.

23. The plasma display panel of Claim 21, wherein
10 for each of the phosphor layers, a phosphor member containing, in a composition thereof, at least one transition metal is selected so as to be included in the phosphor layer.

24. The plasma display panel of Claim 23, wherein
15 said at least one transition metal contained in the composition of the phosphor member is in common with all of the phosphor layers.

25. A plasma display panel in which a pair of substrates are disposed so as to oppose each other and have a discharge space therebetween
20 and in which a dielectric protection layer including MgO and phosphor layers for red, green, and blue respectively are formed so as to face the discharge space, wherein

none of phosphor members included in the phosphor layers contain, in a composition thereof, any member of the group consisting of alkali
25 metals and alkaline earth metals other than Mg.

26. The plasma display panel of Claim 25, wherein
none of the phosphor layers are made of a substance that contains

any member of the group consisting of alkali metals and alkaline earth metals other than Mg.

27. A plasma display panel in which a pair of substrates are disposed
5 so as to oppose each other and have a discharge space therebetween
and in which a dielectric protection layer including MgO and phosphor
layers for red, green, and blue respectively are formed so as to
face the discharge space, wherein

each of the phosphor layers contains at least one member of
10 the group consisting of alkali metals and alkaline earth metals other
than Mg.

28. The plasma display panel of Claim 27, wherein
a total content ratio of said at least one member in each of
15 the phosphor layers is no larger than 60,000 mass ppm.

29. The plasma display panel of Claim 27, wherein
a total content ratio of said at least one member in each of
the phosphor layers is within a range between 1,000 mass ppm and
20 60,000 mass ppm inclusive.

30. The plasma display panel of Claim 29, wherein
a phosphor member included in at least one of the phosphor
layers contains, in a composition thereof, at least one member of
25 the group consisting of alkali metals and alkaline earth metals other
than Mg.

31. The plasma display panel of Claim 27, wherein

a total content ratio of said at least one member in each of the phosphor layers is within a range between 300 mass ppm and 120,000 mass ppm inclusive, and

the total content ratio is substantially same for all of the
5 phosphor layers.

32. The plasma display panel of Claim 31, wherein
variations among the phosphor layers with respect to the total
content ratio of said at least one member are no larger than 40,000
10 mass ppm.

33. The plasma display panel of Claim 31, wherein
for each of the phosphor layers, a phosphor member containing,
in a composition thereof, at least one member of the group consisting
15 of alkali metals and alkaline earth metals other than Mg is selected
so as to be included in the phosphor layer.

34. The plasma display panel of Claim 31, wherein
said at least one member contained in the composition of the
20 phosphor member is in common with all of the phosphor layers.

35. A plasma display panel in which a pair of substrates are disposed
so as to oppose each other and have a discharge space therebetween
and in which a dielectric protection layer including MgO and phosphor
25 layers for red, green, and blue respectively are formed so as to
face the discharge space, wherein

none of phosphor members included in the phosphor layers contain,
in a composition thereof, any member of the group consisting of Group

IV elements, W, Mn, Fe, Co, Ni, alkali metals, and alkaline earth metals other than Mg.

36. The plasma display panel of Claim 35, wherein

5 none of the phosphor layers are made of a substance that contains any member of the group consisting of Group IV elements, W, Mn, Fe, Co, Ni, alkali metals, and alkaline earth metals other than Mg.

37. The plasma display panel of any of Claims 1, 3, 14, 16, 25,
10 27, and 35, wherein

the dielectric protection layer contains at least one Group IV element.

38. The plasma display panel of Claim 37, wherein

15 a content ratio of said at least one Group IV element in the dielectric protection layer is within a range between 500 mass ppm and 2,000 mass ppm inclusive.

39. The plasma display panel of any of Claims 1, 3, 14, 16, 25,
20 27, and 35, wherein

the dielectric protection layer contains at least one transition metal.

40. The plasma display panel of Claim 39, wherein

25 a content ratio of said at least one transition metal in the dielectric protection layer is within a range between 1,500 mass ppm and 6,000 mass ppm.

41. The plasma display panel of any of Claims 1, 3, 14, 16, 25, 27, and 35, wherein

the dielectric protection layer contains at least one member of the group consisting of alkali metals and alkaline earth metals.

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42. The plasma display panel of any of Claims 3, 16, and 27, wherein at least part of a surface of one or more of the phosphor layers facing the discharge space is covered with a phosphor protection layer, the phosphor protection layer (i) having an ultraviolet ray transmittance rate of 80 % or higher, and (ii) having a function of inhibiting one or more of elements included in the one or more phosphor layers that are to degrade discharge properties of the dielectric protection layer from dispersing into the discharge space.

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15 43. The plasma display panel of Claim 42, wherein

any of the phosphor layers whose surface facing the discharge space is covered by the phosphor protection layer contains one or more of (i) at least one Group IV element of no less than 1,000 mass ppm (ii) at least one transition metal of no less than 30,000 mass ppm, and (iii) at least one alkali metal or alkaline earth metal other than Mg of no less than 60,000 mass ppm.

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44. The plasma display panel of Claim 42, wherein

the phosphor protection layer covers the surfaces of all the phosphor layers.

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45. The plasma display panel of Claim 42, wherein

a main component of the phosphor protection layer is MgF_2 .

46. The plasma display panel of Claim 42, wherein
the phosphor protection layer has a lamination structure in
which a first layer whose main component is MgO and a second layer
5 whose main component is MgF₂ are laminated, and
the first layer faces the discharge space.

47. The plasma display panel of Claim 46, wherein
a thickness of the first layer is smaller than a thickness
10 of the second layer.